THE GREAT COURSES®

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The Brain-Based Guide to Communicating Better

Course Guidebook

Allison Friederichs
ROI Training Solutions

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Allison Friederichs is the president of ROI Training Solutions, which provides consulting, training, and speaking services in the areas of how the adult brain learns and professional communication skills. She earned her PhD in Communication Studies from the University of Denver. She is a former Associate Teaching Professor and Associate Dean for Academic Affairs at the University of Denver, University College, where she taught communications courses for more than 20 years and earned the Master Teacher designation for continued professional development.

Allison works collaboratively with trainers and instructors to teach brain-based training and education tactics. Her science-backed techniques leverage knowledge about how the adult brain learns to ensure that learning is actually taking place—regardless of the learner or context. She is an expert trainer of professional communication skills, most often focusing on professional writing skills. Her clients look to her to help them solve the inefficiencies created by poor communication skills among employees and teams.

Allison's clients have consisted of organizations in the public, private, and academic sectors, including Marsh McLennan, Pinnacol Assurance, American Innovations, the US Department of Housing and Urban Development, the Denver Public Library, the Douglas County (Colorado) Government, the University of the Pacific, the Montana University System, the Association for Graduate Enrollment Management, and the Association for Continuing Higher Education. She has been published in academic and trade publications, including *UNBOUND*, *TD* magazine, and *The Chronicle of Higher Education*.

Allison is also the presenter of the Great Course *Written Communications: Being Heard and Understood*.

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The Brain-Based Guide to Communicating Better

Have you ever talked to someone who clearly wasn't connecting with what you were trying to explain, but you couldn't think of a different way to describe it? Or have you ever been frustrated because you told them something multiple times and they kept forgetting it?

This course offers easy-to-apply communication strategies that leverage the unique ways in which adult brains learn in order to improve your ability to communicate effectively. Originally intended for teaching and training contexts, these strategies can easily be adopted by anyone to craft more impactful communication.

The course begins with an exploration of the parts of the brain that are related to communication before considering the many ways we make meaning. Understanding how the brain works augments the practical strategies and practices for better communication in this course.

Next, you'll learn about the intersection of memory and communication, discovering how memory creation and recall work in the brain and how we as communicators can leverage that knowledge to increase the likelihood of our listeners remembering what we communicate.

From there, the course describes how attention works in the brain and discusses strategies for cultivating attention when you're communicating with someone. You'll learn how to connect with others to ensure understanding, focusing on the importance of connecting to prior knowledge and creating enriched environments.

Finally, the last lesson offers practical strategies for mitigating common roadblocks to making clear connections with others. To be a truly impactful communicator, it's important to be aware of challenges you might face when trying to get your point across.

How the Adult Brain Communicates

We've all had miscommunications with others—it's part of being human. But we can learn to minimize the number of those miscommunications by employing strategies that are grounded in knowledge about how the adult brain learns.

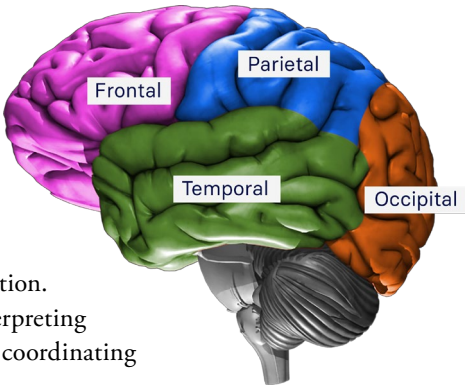
The communication strategies in this course are adapted from a field called neuroandragogy, which examines the intersection of neuroscience—how the brain works—and andragogy, the field of adult learning.

Major Areas of the Brain

- The only things you can control in a communicative exchange are your own communication choices. Learning more impactful communication techniques is not about changing how others communicate; it's about ensuring that your communication is clear and that it lands in the way you've intended. And if you're successful, you're more likely to get the kind of response you hoped for.

- Understanding the science behind how the brain learns makes it easier to put this tenet into action. To work toward that goal, this lesson begins with the basics and examines some of the major areas of the brain.

- Two frontal lobes make up the front section of the brain. They're involved in planning and organizing, problem-solving and decision-making, memory and attention, and controlling behavior and emotions. These are all functions that are critical in communication.

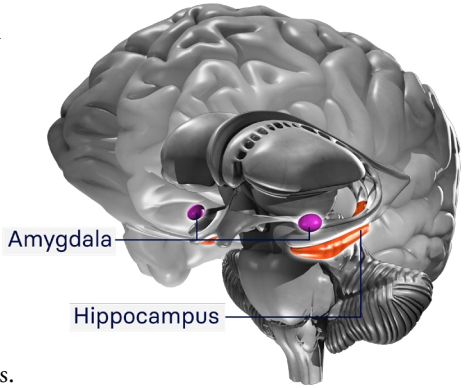


- The parietal lobes are found just behind the frontal lobes. They help us integrate sensory information from various parts of the body; coordinate hand, arm, and eye motions; and provide visual-spatial navigation. They are also responsible for interpreting words, processing language, and coordinating attention.

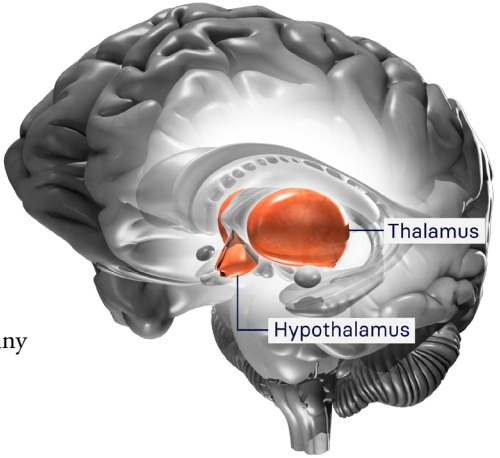
- The temporal lobes are located behind the frontal lobes at about the level of the ears. These lobes are involved in recognizing and processing sound, understanding and producing speech, and assisting with certain aspects of memory.

- The amygdala, a small but mighty area in the medial temporal lobe, helps with the formation and storage of information related to events that are emotional for us. Emotions play a critical role in communication. The amygdala also facilitates long-term memory formation, converts and retains learning from pleasure responses, and helps us recognize when we're afraid or potentially in danger.

- The hippocampus is also located in the medial temporal lobe. It's responsible for memory creation and retention as well as helping us orient ourselves and navigate our surroundings. Memory creation and retention are important to communication, as what we remember impacts how we communicate in future situations.



- Located just above the brain stem, the hypothalamus helps us recognize hunger and thirst, releases critical hormones, and plays a role in our emotional responses and our mood—which can certainly have an impact on how we communicate in any given moment.



Check out brainline.org for an interactive map of the brain.

How Data Is Turned into Knowledge

- There are a few areas of the brain this lesson doesn't cover, such as the brain stem and pituitary gland. Instead, it focuses on how data is turned into knowledge. The reticular activating system, located in the brain stem, is essentially the gatekeeper for all the data that enters from your environment and passes into your brain. The data is stored, organized, and retrieved through complex processes.

- The brain is comprised of approximately 100 billion neurons, though the exact number is disputed. These cells contain nuclei, which make enzymes, proteins, and neurotransmitters. These are the chemicals necessary for the nerve cells in the brain to communicate with one another.

- Neurons have a single axon, which is a long tube that sends electrical impulses—called action potentials—to other cells. And neurons also have dendrites, which are basically like little hands that receive electrical impulses from the axon terminals of other neurons.

- A synapse is the specialized site at which that communication happens. You can think of a synapse as a bridge, where the road leading to the bridge is the axon and the dendrite is the road on the other side. The synapses connects the two sides, allowing the electrical impulse to travel across. All of these things together form a neuronal network.

Social Learning

- The functions of the brain's limbic system and prefrontal cortex illustrate an essential relationship between social connection and learning. The limbic system is not technically a single system; it's a group of structures related by their location and functions.

- The limbic system regulates people's behavior—most important for this context, with regard to emotion and the ways in which people maintain connections with others. The relationship between social connections and the brain cannot be overstated. In fact, social cognitive neuroscientist Matthew Lieberman asserts that the brain's primary purpose is social thinking.

- Social learning systems enable successful human engagement. One of the ways in which people connect emotionally with others is through the process of interpreting what someone else is thinking or feeling. And these social learning systems developed early on. Whereas more solo cognitive abilities rely on the more recently developed frontal and prefrontal cortex, Lieberman asserts that the brain's main purpose has been social-bound for tens of millions of years.

- Looking back over the millennia, the growth of more and more complex social groups among humans led to the development of three cognitive abilities in the prefrontal cortex: social intelligence (understanding and using one's connection to others), environmental intelligence (figuring out how things work), and language (sharing and exchanging with others what we know, think, and feel). This suggests that the learning process developed not only in tandem with, but likely because of, social connections.

EXERCISE

Can you remember the last time you were struggling to learn something new? Perhaps it was learning how to put together a piece of furniture, or maybe you were trying to figure out how to work your new telescope. Whatever it was, did you enlist the help of anyone else, even if it was just to share the fact that you were having a hard time figuring it out? It's through this connection with others that learning is often facilitated.

How We Make Meaning

- Social learning is made complicated by the individualized ways that humans make meaning. Structurally, our brains are mostly alike, but the way they construct meaning is different. The fact that we make meaning differently means we perceive the world differently, which means we not only communicate about how we see the world differently, but we also communicate differently about how we see the world.

- Think about all the ways these varying perceptions manifest in communication, from something as simple as an opinion about food to something more complex, like our political or religious beliefs. We're likely not born with these preferences preprogrammed. Even the simplest beliefs, like the tastiness of a food item, are at least somewhat meaning-based.

- To add another layer of nuance to this, consider how we make meaning with language. Benjamin Bergen, author of *Louder Than Words: The New Science of How the Mind Makes Meaning*, explains something called the embodied simulation hypothesis, which says that we understand language by simulating in our minds what it would be like to experience the things that the language describes.

- He offers a great example to illustrate this theory. Imagine the phrase "flying pig." Even though you've never seen a flying pig, you can immediately conjure up an image of one in your mind. You do know what flying is, and you do know what a pig is. So you can simulate a flying pig by putting together what you do know as a visualization in your mind.

- But is your image of the flying pig the same one someone else would have? Perhaps you picture your pig as a cartoon, and someone else pictures an actual pig. Or perhaps you picture it flying with its front and back legs extended, whereas someone else pictures it using wings to fly.

Adults learn by leveraging the body of experiences we bring with us to any particular learning event. Whether it's picking up a new skill or just trying to understand what someone is saying to us, our experiences serve as a lens that informs how we engage in learning in that moment.

- Meaning is something you construct in your own mind based on your own experiences and the visual and mental images already associated with them. And because every single person has had experiences that are, as a body of experience, unique to them, the meanings we construct in our mind are unique to us.

- All of this impacts how we communicate. If your boss tells you to draw a flying pig for a new ad campaign and you draw the one in your mind, but they're expecting the one in their mind, you've just had a miscommunication. Add to this the fact that most of our communicative exchanges include complex, multi-history, multilayered meanings about the myriad symbols included in each and every exchange, and it's a wonder we ever communicate effectively!

- Remember that these unique experiences that each of us brings to the table not only impact the meaning we make of any given symbol, and any given communicative interaction, but they also impact how we learn. It truly is a challenge for any teacher or trainer of adults to find ways to allow each learner to leverage their unique experiences to learn the concepts being taught. But it is possible by leveraging what we know about how the brain learns.

COMMON MYTHS ABOUT THE BRAIN

True or false: Learners are either left-brained (in other words, rational and analytical) or right-brained (intuitive and creative).

False! It's a gross oversimplification to think of any part of the brain as being solely responsible for any one task.

True or false: Humans use only about 10% of our brains.

False! Researchers have found that this is one of the most pervasive myths about the brain. We actually use 100% of our brains nearly all the time—even while we sleep.

True or false: Our brains' structure is fixed, which means our capacity to learn is somewhat predetermined.

False! Genetics does play a role in our cognitive abilities, but it's absolutely a myth that we can't learn new things at any point in our lives. A concept called neuroplasticity says that the more we continue to challenge our brains by learning new things, the more we continue to grow new neuronal networks.

Reading

Bergen, *Louder Than Words*.
BrainLine, "Interactive Brain."
Taylor and Marienau, *Facilitating Learning with the Adult Brain in Mind*.
Willis, "What You Should Know about Your Brain."
Zull, *The Art of Changing the Brain*.

Questions

1 What are three examples from your own life in which your prior experience played a role in how you interacted with what you were learning or who you were communicating with?

2 True or false: You should try to control how other people communicate.

Messages That Activate Our Brains

Have you ever had an argument with a loved one that was based on memory? Perhaps they remembered something differently than you, or perhaps they forgot something altogether. Memory has an important role to play in communication. If we can leverage the power of memory, we can positively impact future communications.

How Memory Works

- The first stage of memory is sensory memory. It holds just a quick flash of everything our sensory systems take in, such as sights, smells, and sounds. Sensory memory is so short-lived—most experts say about three seconds—that most of it doesn't even make it into our conscious awareness. Instead, it allows us to discern what sensory data to pay more attention to and then transfers the details of that data to short-term memory.

- Most experts say short-term memory holds about seven items at any given time and lasts for approximately 15 to 30 seconds. But you can increase the number of items you can hold in short-term memory as well as the extent to which you can recall them through tactics like repetition and mnemonic devices.

- Working memory is like a temporary mental work space where we bring together short- and long-term memory to carry out a task, achieve a goal, or solve a problem. For example, if you're trying to add 26 and 37 in your head, you'd use long-term memory to recall how to do addition and short-term memory to remember the numbers you're currently working with.

- Working memory helps us concentrate in the moment so that we can carry out these tasks, but it has limited capacity. Most researchers suggest we can only keep so much in mind at one time. But by employing certain techniques, the items in working memory can be transferred into long-term memory.

Your current context—meaning your environment, mental state, thoughts, and emotions—plays a role in what long-term memories are cued up. You might find yourself recalling seemingly forgotten childhood memories or songs you knew years ago simply because your brain categorizes something in your current context as similar to the context in which those memories were created.

- Long-term memories are made when the hippocampus retrieves information from the working memory and makes changes to the brain's neural wiring. But all of these new connections don't necessarily become permanent long-term memories. Memories must continue to be retrieved or put to use in some form to be retained in the long-term memory bank. This is why, for example, you might recognize an actor's face but not necessarily remember their name. You simply haven't had to retrieve their name on enough occasions for it to be permanently stored in the bank.

Types of Memories

- The types of memories we have are based on the types of data the memories contain.

- Grab a piece of paper and write down five facts you know. They can be about absolutely anything—a car has four tires, or London is in England. What you've just tapped into is semantic memory, which involves facts you've learned about the world.

- Think back to three times in your life when you experienced joy. Now, you're recalling episodic memories. These are memories you have of things that happened in a particular context, time, or place in your life. Do you remember your first kiss or when you first learned to drive? If so, you likely remember the sounds, sights, and smells associated with that memory. Those are all part of episodic memories.

- Next, think about three things you know how to do without having to look anything up. What skills or tasks can you complete that you know like the back of your hand? These are procedural memories—things you know how to do.

- Where do you want to go for your next vacation? Do you already have it planned? Prospective memories are memories about things you're planning to do in the future. It's interesting to think about memories as things that haven't yet happened, but they are things that you've already thought about, and thus they exist as memories of things you want, intend, or plan to do. Even something as simple as remembering to grab your lunch before you leave the house is a prospective memory.

Emphasizing Context and Purpose

- Think about how many of our miscommunications with others are grounded in what we remember. If you're able to leverage what we know about how memory works, you can create a positive impact on communication by maximizing the likelihood that the person with whom you're communicating remembers what you've said, what you've agreed on, or what just happened.

- The first strategy for leveraging memory toward improved communication is to emphasize context and purpose. In the classroom, this manifests as having students understand why they're learning something and how they'll use it in the future. Why not apply the same in everyday communication?

> We're all busy in our everyday lives. If someone shares a piece of information with us and we don't have a legitimate reason to attend to that information, we render it useless and move on.

- If you're communicating with a colleague and you want them to remember something—say, where they can find a policy—try to get them to imagine a future where they'll definitely need to draw on this information. Then, they'll be more likely to attend to it, so it passes into their short-term memory.

EXERCISE

Think of three examples of miscommunications you've experienced. Were any of them impacted by the other person's lack of understanding of the context or purpose of the information you shared? If so, imagine applying this strategy. How might the interaction have gone differently? What might have been the outcome?

Creating an Emotional Experience

- Somewhat related to the strategy of applying context and purpose is the next tactic: bringing emotion into the fold. Researchers have found that when we encounter something that's an emotional experience or to which we have an emotional reaction, the memory and emotional processes in the brain interact in a unique way. More emotional memories undergo stronger encoding in the memory.

- It's one thing to experience something emotional—a car crash, your child being born, your wedding day, or a terrible fight with a friend—but it's another thing altogether to create an emotional experience when you're communicating with someone. There are two possible tactics you can try.

- First, you can try to create an emotional response to an interaction. You might take a cue from the advertising world. They typically target one of six emotions: happiness, sadness, disgust, anger, surprise, or fear.

- The second tactic is to relate the interaction to an emotion or emotional experience rather than trying to make the interaction itself emotional. Connecting new information to something a person already knows by way of analogies can be a powerful way to get them to connect with what you're saying. And if they connect with it, they're more likely to remember it. So, consider ways that you can relate the interaction to a previous event, a compelling news story, a funny anecdote, or even a previous emotional memory of theirs.

EXERCISE

Identify one miscommunication you've experienced and choose one of these six emotions to target. Imagine how this interaction might have gone differently.

EXERCISE

Use one of your previously identified miscommunications to craft an example of how an interaction might have gone differently by using an analogy to link to something emotional.

Employing Mnemonic Devices

- Do you know all the colors of the rainbow? How about notes on the musical scale? If you remember them by "Roy G. Biv" and "every good boy does fine," you're employing mnemonic devices. This is the last strategy for leveraging what we know about memory in your communications.

- Mnemonic devices make it much easier to remember things in a few different ways. First, they create associations between the new information and something the listener already knows. Much like analogies, if a person can associate something they already know with this new piece of data, they're more likely to remember it.

- Second, they use cues, patterns, and associations to organize information in a way that makes it easier to retrieve later. You may have no inherent association to remember that the letters on a music scale are E, G, B, D, and F, but you do already have an inherent association with standard American English syntax, making the mnemonic "every good boy does fine" easy for you to remember.

- Mnemonics also typically make it easier to visualize information. We understand language by simulating in our minds what it would be like to experience the things that the language describes. So when we can create associations that the mind can easily visualize—like a flying pig, for example—those things are easier to remember than a bunch of random words or facts.

- Think about the mnemonic devices you're familiar with. Acronyms are common because they're easy to create, use, and remember. They're formed by using the first letters of the items you want to remember. One example is Roy G. Biv, but there are countless acronyms we use every day, like NASA and OSHA. It would be quite easy to construct one in your own everyday communication.

- Do you remember that the year Columbus sailed the ocean blue was 1492? That easy-to-remember fact is an example of a rhyme mnemonic. This is one of the easiest mnemonics to create for everyday communication. For example, if you're trying to get your spouse to remember the three tasks you want them to do today, you could create a rhyme like "pet store galore; don't break the rake; and it's time for my wine."

Reading

Cabeza et al., "Brain Activity during Episodic Retrieval."

Osth, "Here's Why Memories Come Flooding Back When You Visit Places from Your Past."

Questions

1 What are the distinctions among short-term, working, and long-term memory?

2 True or false: Connecting an emotional response to an interaction will help cement the information in someone's memory.

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How to Get and Hold Our Brains' Attention

If you've ever tried to talk with someone while they were watching TV or checking their Facebook feed, you know how difficult it can be to get someone's attention and keep it long enough to communicate effectively. But there are ways to cultivate attention to maximize the impact of the way we present information.

The Cocktail Party Effect

- The world is so full of sensory stimuli that our brains can't possibly attend to all of it. Instead, those stimuli pass through the various sensory pathways into the thalamus, which blocks the passage of certain stimuli to allow focus on those that are more relevant.

- This process takes place either voluntarily or involuntarily. We can voluntarily filter information in a process called selective attention—selectively attending to only one stimulus among many competing stimuli. Some experts liken the process to a searchlight, where the brain shines a brighter light on a stimulus of interest, but new research suggests that it's actually more like the brain dims the light on stimuli not of interest.

- However the brain does it, the effect can be understood through a concept called the cocktail party effect. If you're at a cocktail party talking to a person you find interesting, even though the party may be loud with lots of competing stimuli, you have no trouble using selective attention to focus on the person you're talking to. But if a competing stimulus comes along—say, the crash of a tray of drinks or someone calling your name—then your attention shifts involuntarily to the new stimulus.

- The brain tends to involuntarily attend to stimuli that have certain characteristics. First, we attend to things we're already looking for or are trained or habituated to notice. This is known as frequency illusion. It's why, for example, an architect will more readily notice building issues, or why a proofreader will more readily notice grammatical mistakes.

- We also attend more readily—involuntarily, that is—to things we expect to see or want to see. This is similar to frequency illusion but has more to do with a concept called confirmation bias. We tend to subconsciously seek out people and information that confirm and support our already-held views, and we tend to ignore those that challenge them. Therefore, the types of stimuli that support our views are what we're more likely to notice.

- Imagine you're working on a project at your desk, but then you're interrupted by a loud disagreement between two people in the hallway. You're going to notice that. This demonstrates that we tend to attend to stimuli that are distinct—louder, brighter, and so on. We're also more likely to notice things that are particularly good, like a puppy, or particularly bad, like a snake.

COMMON MYTHS ABOUT THE BRAIN

True or false: Our attention spans are now shorter than that of the average goldfish.

False! Dr. Gemma Briggs notes that the whole notion of an average attention span is a myth. Attention is actually task-dependent, and it has everything to do with the extent to which a person is motivated to selectively attend. (And, by the way, experts on fish behavior say goldfish are actually quite capable of memory and learning and do not, in fact, have short attention spans either!)

Task-Switching

- It's probably evident that the most virulent enemy to cultivating attention is multitasking. But the truth is that the whole concept of multitasking is a myth. The brain is simply not capable of it.

- Instead, we engage in task-switching. Rather than actually engaging in two tasks at once, we're switching back and forth between two or more tasks quickly. But we aren't doing any of them very well, and we're certainly not creating any lasting neural connections.

- Almost every expert agrees that task-switching negatively impacts short-term memory. In terms of everyday communication, this means that if you communicate with someone while they're engaging in any other task, the information you share is less likely to pass through the reticular activating system into short-term memory, which means it can't be recalled as working memory and won't become long-term memory.

- The most common culprit behind our propensity to task-switch is technology. Although most research does not indicate that technology negatively impacts learning, memory, or academic performance, the research does point to the negative impact of technology on attention.

- And research points to consistent findings that it's not just the use of technology that's having a negative impact on attention, but in particular, it's the act of multitasking while using technology. Attentional distraction can result in the inability to hold information in memory, even for short periods of time. If information doesn't get held in short-term memory, it never moves to long-term memory. Therefore, no learning takes place.

Smartphones can be a major obstacle to getting someone's attention. The internet is chock-full of stimuli that involuntarily capture our attention, and incoming texts do the same. One study found that the mere presence of a mobile phone—not even its use—can reduce cognitive capacity.

- All of this points to a pretty dismal picture of the likelihood of getting and keeping someone's attention when you're communicating with them. But there are a few strategies to accomplish this. To combat inattention, be sure the person you're communicating with isn't multitasking when you're talking to them.

- When the person you're talking to is engaged in another task while you're trying to talk to them, you can do one of two things. First, you can simply wait for them to finish before you talk to them. The second option is to simply ask them to focus their attention on you.

- This tactic has more to do with what you're doing than how you're communicating. If you're multitasking, the other person will take it as license to do the same. People tend to respond to your behavior with similar behavior of their own. So, give your communication partners the same undivided attention you hope for from them.

The Power of Inquiry

- The next strategy for cultivating attention is to leverage the power of inquiry. Instinctive elaboration is a mental reflex where, when you're asked a question, your brain instinctively thinks of nothing else but that question. The idea is likely an oversimplification, but it points to something we do know about the how the brain reacts to curiosity.

- Neuroscientists Matthias Gruber and Charan Ranganath found that the more curious someone is to find out the answer to a question, the more activity takes place in the midbrain and nucleus accumbens. These are the areas that are involved when we anticipate rewards, like money or food. So, curiosity involves the exact same brain areas that are involved in tangible, extrinsic rewards.

- Fascinatingly, it's also been found that being curious affects learning any information. When a person's curiosity is aroused, that person is more likely to recall the information they've learned, but they're also more likely to be able to recall peripheral information—that is, information that was learned alongside the direct information, such as incidental visual images.

- So, how can you spark the curiosity of the person with whom you're communicating so that they're more likely to be attentive and to recall the information later? Asking the right question can pique their curiosity.

- Consider how often you've been asked these types of questions: "Do you remember…?" or "Can you help me recall…?" Now, think about your internal response when someone asks you questions like this. Do you remember? These are review questions, and they tend to pique our curiosity.

- You can also ask generative questions, which are questions that open the door to the exploration of a particular topic. Think about questions like "I wonder…" or "Do you think…?" Now, it certainly isn't always the case that just because you wonder about something, you'll pique the other person's curiosity. The onus is still on the communicator to wonder about a topic that will interest the other person.

EXERCISE

Consider two recent exchanges you had with someone where you needed to cultivate their attention. For each scenario, think about how you could leverage the power of inquiry to pique that person's curiosity.

Borrowing Tips from Good Writing

- One last strategy for cultivating attention is to borrow tips from good writing. First, be clear and concise. The surest way to lose someone's attention is to be vague or to prattle on. Your communication must keep their interest for them to selectively attend to it, so you can make it easier for them by speaking clearly and keeping your messages succinct.

- The second tactic is to consider your audience. When writing, you must write what they need to know, not what you want to say. The same basic idea applies here. You should consider ways to connect to your listener. Instead of focusing solely on what you want to say, focus on saying something they can relate to.

- Think about it: If people don't see themselves in what you're talking about, they'll check out. We're only interested in your story to the extent that we can connect with it. This is why people always respond to your stories with like stories of their own. People need to feel a connection to selectively attend to what you're talking about.

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Lodge and Harrison, "The Role of Attention in Learning in the Digital Age."
Maybin, "Busting the Attention Span Myth."
Eyal, Nass, and Wagner, "Cognitive Control in Media Multitaskers."
Singh, "Curiosity: It Helps Us Learn, But Why?"
Ward et al., "Brain Drain."
Yuhas, "Curiosity Prepares the Brain for Better Learning."

Questions

1. How can you actively cultivate the attention of someone you're communicating with?

2. True or false: If you're really intelligent, your brain can process all of the stimuli coming at you at any given time.

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Guiding Brains with Inquiry and Analogy

You can leverage what we know about how the brain learns to become more skilled at getting your point across to another person. Inquiry and analogy are easy-to-apply tools for connecting to your listeners' prior knowledge and avoiding miscommunications.

Growing Synaptic Connections

- One of the principles of andragogy—the theory that adults learn differently than children—is that adults accumulate experiences that become an increasingly rich resource for learning. Clive Wilson, author of the book *No One Is Too Old to Learn*, asserts that there are biological changes that occur in the brain as a result of one's experiences.

- We don't process all stimuli the same way. When stimuli enter the brain in the form of electrical impulses, they are stored in order of importance. Some data is processed with a low-level, weaker signal, and some data is processed with a high-level, stronger signal. Prior experience makes the difference in how our brains process the data.

- Prior experience with data leads to a stronger synaptic connection. Less or no experience leads to a more feeble connection. And only strong synaptic connections are turned into long-term memory. With feeble connections, the connection is ultimately lost, so no learning occurs.

- Remember that in a neuronal network, axons send action potentials to other neurons, whose fingerlike dendrites grab onto those action potentials at the specialized site called a synapse, forming a synaptic connection. According to James Zull, author of *The Art of Changing the Brain*, neuronal networks are knowledge. Every time we learn something new, a synaptic connection is made.

- So, learning—or, in other words, growing more synaptic connections—must come from a physical change to our neuronal networks. New information must be connected to an existing neuronal network—to existing knowledge. Zull says it best: "No one can understand anything if it isn't connected in some way to something they already know."

Imagine two relay runners. One is coming up just behind the other, getting ready to pass the baton, but then it drops to the ground.

The runner in front represents the dendrite, and the runner in back represents the axon. The baton is the synapse. If the new information you're explaining to someone has no connection to something that already exists in that person's mind, the baton is dropped. No connection is made, and no learning takes place.

"Fish Is Fish"

- In a children's story called "Fish Is Fish," a minnow and a tadpole are childhood friends. The tadpole eventually turns into a frog and leaves the water. After a while, he returns and tells the minnow about all the extraordinary things he saw on land—birds, cows, and people. But while the frog is telling his friend about all these land items, the fish is imagining them with fish heads, gills, and fins.

- The fish had preconceptions that actually manifested as misconceptions, making it difficult to learn anything further about land life. And the same thing happens when you communicate with others. People have preexisting conceptions that can make understanding new information difficult or even impossible if the preexisting conceptions are not addressed.

EXERCISE

Can you think of a time when someone was teaching you something new and you had a difficult time making a connection to the new information? Consider the disconnect. When this person was explaining the concept to you, why didn't you get it? It's most likely because they were not connecting the new knowledge to anything existing in your head.

Inquiry

- There are two important things to understand about what learners already know. First, prior knowledge is a fact. Everyone has some prior knowledge of something. And second, prior knowledge is always the building block of new knowledge. When you communicate with other people, if you don't connect the new knowledge to the existing knowledge in the listener's head, no connection is made.

- It's your job as a communicator to connect the new information you're trying to impart to something the listener already knows or has experienced. One of the best ways to do this is simply to ask them what they already know or what they've already experienced.

- It can be helpful to have your toolbox stocked with potential inquiry prompts. Here are a few suggestions to get you started:
  - What is your experience with…?
  - Do you remember…?
  - What do you know about…?
  - Have you ever…?
  - What historical context can you share about…?

EXERCISE

See if you can come up with three or four more ways to leverage inquiry to connect with your listener's prior knowledge or experience. It may help you to consider one or two recent exchanges you've had with someone. Even more specifically, you can consider exchanges in which you could have done a better job of connecting with what they already knew.

Being a Good Listener

- When you employ your newfound inquiry skills, they have to go hand-in-hand with another critical skill: listening. When you ask a question, you then yield the floor to your listener to become the speaker while you become the listener. If you're trying to connect to someone and you yourself can't be a good listener, you're not likely to make the connection.

- It's easy to get distracted when trying to listen to someone. When we try to selectively listen to someone else, our brains use a top-down process to attend to the stimulus we're trying to focus on. Auditory neuroscientist Seth Horowitz likens it to putting on a pair of noise-cancelling headphones: Our brains can somewhat drown out the many stimuli going on around us to focus on what we've selected to attend to.

- The problem is that when something competes with the selected stimulus—something like your name being called or a loud noise—there are bottom-up pathways that take over as a kind of defensive mechanism. If you don't know the origin of the noise, you don't know what it is, and it could be dangerous.

- Even if you're lucky enough to get through a conversation with no stimuli competing with what you're selectively attending to, our brains are just so good at thinking that it's hard to focus on one person speaking. We can often get so sidetracked into our thoughts that we miss something the other person has said.

The average American talks at a rate of about 125 words per minute, but our brains process thoughts at a much higher rate.

○ If you're trying to connect to someone by inquiring about their prior knowledge and you don't listen to their answer, that connection will be lost—especially if they can tell you weren't listening. Using the tools shared in this course will help you become a better communicator, but you also have to be a genuine and empathetic listener.

Analogy

○ The next way you can connect to your listeners' prior knowledge is to use analogies, including things like examples, stories, and metaphors. Consider this exchange between a theologian and this course's presenter, Allison Friederichs.

○ Allison had always considered faith as something you're struck with in a lightning-bolt aha! moment, but the theologian countered that faith is a decision to commit your life to a belief. Allison told her she didn't understand how one can commit to believing in something that you can't know for sure exists.

○ The theologian asked her, "Why do you stay married to your husband?" And Allison replied, "Well, because I love him, and he's the best person I've ever known, and he makes me a better person."

○ Then, the theologian asked, "Do you know with 100% certainty that he's the only person in the world you could have had a happy marriage with?" Allison answered, "No, I suppose I don't." The theologian said, "But you stay married to him anyway. That's faith." And Allison got it.

○ That one simple analogy afforded Allison a much more concrete understanding of faith because she was able to make a connection between the new concept—faith—and something she already understood—her marriage. Using analogy is an easy and effective way to allow people to relate new concepts to something they already know.

EXERCISE

Think back to a communicative exchange where your information just wasn't clicking with the other person. First, identify where you lost them. Where did you drop the baton? Next, consider how you might have used an analogy to connect to something they already had experience with.

Reading

Horowitz, "The Science and Art of Listening."
Nichols and Stevens, "Listening to People."
Wilson, *No One Is Too Old to Learn*.

Questions

1 What was the point of the "Fish Is Fish" story in this lesson?

2 True or false: Analogies are excellent tools for connecting new knowledge to something that already exists in the listener's head.

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Enriching the Conversational Environment

What were your favorite learning programs when you were a child? Do you still remember any of the lessons from them? We still remember things like this years later because these programs use enriched environments to engender learning.

Creating Enriched Environments

- The adult brain has plasticity, which means that as long as it's stimulated, it can to continue to build new connections. The most impactful kind of stimulation takes place when the learner is in an enriched environment—that is, one with multiple types of stimuli.

- Our brains produce a more congruent image when presented with stimuli from many different avenues, including pictures, charts, smells, stories, colors, and music. These are all examples of multimodal stimuli that help create enriched environments. When teaching—whether in the classroom or in everyday life—you want to avoid low-frequency activities, such as lessons, and use high-frequency activities, which employ multiple modalities to increase the likelihood of strong synaptic connections.

- In a marine biology class, the teacher would want their students to learn about conservation by getting them to connect emotionally with the blue whale. They might play blue whale sounds and show a picture of a mother blue whale swimming with her baby. Then, they might tell the students to remember the last time they ate a hard-boiled egg and explain that that's what a blue whale's skin feels like. They would tell them that the baby blue whale gains nine pounds an hour, and if humans gained weight at that rate, we would all weigh 216 pounds more by this time tomorrow.

Researchers have found that mice living in enriched environments grow 60% more new neurons and perform better on learning tests. And Clive Wilson, author of the book *No One Is Too Old to Learn*, reports that similar results are being found in adults ages 50 to 70.

EXERCISE

Think about what songs or jingles you remember from when you were much younger. Now, ask yourself if you remember the date the Magna Carta was signed.

It's quite likely that you remember the jingles but not the random fact. This is because the jingles are examples of enriched environments: exciting visuals and words and music all together. Had your history teacher sung you a song about the Magna Carta, or perhaps assigned you to write a poem about it, you might still remember the date—which was 1215, by the way.

○ The students would be more likely to connect to—and thus remember and learn—this information because the teacher used multiple modalities to share it. To add even more frequency, the teacher could have them search on their own for startling facts about whales and conservation and share them with the class, or perhaps have them craft an action plan for engaging in conservation efforts. The more modalities and frequencies the teacher uses, the more engaged the students are, and the more likely they are to learn.

Strategies for Adding Modalities

- Think about the ways you tend to communicate—in person, by email, by text, and so on. How can you add modalities in your everyday life to enhance understanding?

> Adding modalities isn't just relegated to virtual communications. It's easy to pull up a quick picture or video in face-to-face communications to illustrate a concept or idea.

- When you send emails, think about including helpful resources such as websites, files, maps, and references to earlier emails. You can also use some of the same strategies used in teaching—using colors and sounds, for example. You can highlight important information or insert a video or sound clip to illustrate or supplement what you're writing.

- You can also use the person you're communicating with as another modality by asking them to explain the concept or information to someone else. There are multiple studies that demonstrate that teaching someone else is a highly effective way to cement learning. They have to search their brain for the new information and make sense of it to share it themselves.

EXERCISE

Imagine a few recent or common virtual interactions you have that might be enhanced with the use of one of these tools.

- Something as simple as repetition is also quite effective. Repetition increases the likelihood of building a neuronal connection. We must interact with new information multiple times to create the structural changes that create long-term memories. And repetition must be spaced out to ensure learning. If you want your spouse to remember to pick up a package in 14 days, you should remind them two or three times between now and then.

Chunking and Scaffolding

- Chunking is another strategy for ensuring connection with others. It has to do with breaking complex information into digestible chunks. Remember how neuronal networks talk to one another through action potentials traveling across synapses? After repeated release of action potentials across a synapse, the brain needs to rest and restore to be available for that action when the next message comes traveling along the neuronal circuit.

- It's evident that students need breaks so they can take a moment to grab on to the newly learned material. Failure to do this leads to failure to remember and, subsequently, failure to learn. When we put information into patterns or chunks—such as we do for telephone numbers—we can more easily remember them. Another example of this is breaking things down into the familiar categories of who, what, when, where, and why.

- Scaffolding is a related approach you can use when the information you're trying to convey is a bit more complex. In this strategy, the person doing the teaching or communicating provides helpful hints, prompts, reminders, or encouragement at the right time to ensure connection with the learner. Raymond Wlodkowski offers specific tips for how you might engage the skill of scaffolding when teaching something complex.

- The first method is modeling, which is simply when the person teaching carries out the skill while the learner observes.

- The next method is anticipating difficulties. In this model, the teacher asks the learner where they are likely to need support. When you can anticipate where your listeners will have difficulties processing information, you'll be a much more impactful communicator.

- Another tip is to provide learners with things like prompts, cues, or checklists. For example, you can list things in a number of steps rather than in a long narrative.

- Perhaps the most important tip for assisted learning is to provide true scaffolding—that is, build up to difficult or complex tasks, skills, or knowledge. Scaffolding should involve baby steps toward complicated knowledge and opportunities to practice the baby steps, as well as the final knowledge component, in a low-stakes environment.

EXERCISE

Consider a time you had to explain a complex process to someone. Now, apply each scaffolding tip to the scenario. How would scaffolding have helped the interaction go more smoothly?

- Have you ever been called on to teach someone a process that you know like the back of your hand? If so, chances are you showed them the entire process in one fell swoop. Imagine how differently it might have gone had you used scaffolding and only taught them one or two steps initially, let them ruminate on and practice those for a couple of days, and then built on them. It sounds like it might take more time, but we often spend more time correcting mistakes and misunderstandings if something isn't taught effectively the first time.

Jargon

- To ensure you're making a connection with others, it's best to avoid using jargon. One study found that the use of jargon leads to "motivated resistance to persuasion," which they define as a person's motivation to oppose or resist perceived efforts to change existing attitudes. Increased jargon use also leads to a "difficult processing experience," which can lead to a lack of confidence, liking, and trust in the person doing the communicating.

- So, how can we know whether we're using jargon that someone else will find annoying to the point that it impacts their confidence and trust in us and our message? The key here is that people are looking for us to say something substantive.

- If you say we need to "think outside the box," you actually mean "we'll need to be creative or innovative." Instead of saying "let's get our ducks in a row," it's clearer for you to say "let's make a plan." And instead of suggesting we "move the needle," you should be clear about what that looks like. Do you want to see increased sales numbers? A change in buyer behavior? A revised business plan? Be specific.

○ Do you tend to use these kinds of phrases that can come off as vague, obtuse, or even pretentious? Sometimes people use jargon to show that they're in the know in a particular industry, but unless you're talking to someone else you know for sure knows that term, you haven't impressed your listener—you've alienated them. Most people are not likely to ask for a clarification of the term you've used; they'll just check out of the conversation. Thus, by using jargon, you're almost certainly preventing understanding and connection.

Reading

Boyd, "After Watching This, Your Brain Will Not Be the Same."
Bullock et al., "Jargon as a Barrier to Effective Science Communication."
Kang, "Spaced Repetition Promotes Efficient and Effective Learning."
Wlodkowski, *Enhancing Adult Motivation to Learn*.

Questions

1 What are some examples of ways you can create enriched environments when communicating with others?

2 True or false: When using repetition as a tool to cement knowledge, it doesn't matter how frequently you repeat the information.

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Overcoming Roadblocks to Communicating Well

So far, we've examined the structure and function of the brain to explore ways to leverage memory, cultivate attention, and create connections in our communications. This last lesson explores ways to mitigate common roadblocks to connecting with others.

Anxious versus Curious Brain

- The first roadblock to communicating is a concept coined by Kathleen Taylor and Catherine Marienau called the anxious versus curious brain. In their book *Facilitating Learning with the Adult Brain in Mind,* they suggest that unless teachers attend sufficiently to the mediation of perceived threats, adults may "not have enough presence of mind to learn."

- Thinking back to the dawn of humanity, survival was the number-one thing on any person's mind. Our brains were essentially wired to have only two states of mind: anxious or safe. The anxious brain is always on alert for danger. If a person is under stress, their brain will divert all of its rational information-processing capacity to deal with the danger at hand. Once the brain senses that the threat has passed, they may return to other forms of information processing.

- Today, the need to feel safe has evolved to the need to be right. If you're right, you feel secure; if you're not right, you feel threatened. Adults' brains are automatically in anxious-brain mode when they find themselves in a new learning environment, no matter how excited or motivated they are to learn. And the parts of the brain that can focus on problem-solving, critical thinking, and rational reflection are on hold.

- When we feel safe and secure, on the other hand, we can switch on our curious brain. The curious brain inquires and wants to learn. But if we don't attend to the anxious brain's concerns, the curious brain stays in the background.

Chronic stress can affect brain structure and function, and negative emotions can even reshape neural tissue.

- After danger, emotional input is next on the list of what the brain prioritizes attending to. Emotional response is controlled by the amygdala, which suspends complex processing and rational thought when the emotional response to something is high. It's only after danger and emotion are attended to that the brain can prioritize information relevant to previous experiences.

- According to David Sousa, author of *How the Brain Learns*, emotions affect learning in two ways: first, through the environment in which the learning takes place, and second, through an emotional connection to the content itself.

- If the learning environment feels positive for a learner, the brain releases endorphins stimulating the frontal lobe, which is responsible for higher-level thinking and problem-solving. In a learning environment that feels negative—such as stressful or frightening—the brain releases epinephrine rather than endorphins. Cortisol is the hormone involved in the fight-or-flight response.

EXERCISE

Take a moment and think back to times in your life when you were frustrated, annoyed, frightened, or even just feeling under scrutiny or pressure while trying to learn something new. How was your ability to attend to, comprehend, and learn new information impacted? Research demonstrates that in these negative emotional situations, cognitive performance suffers.

Creating a Safe Space

- Your charge as a communicator is to create a safe space for everyone you communicate with. There are multiple ways you can do this.

- First, explain and model to the other person that it's OK to make mistakes and even to fail. The important thing shouldn't be whether others fail but rather whether they learn from their mistakes. Treat mistakes and failures as learning opportunities.

- Another way to create a safe space for communication is to create opportunities to foster confidence. To do that, you can use the chunking and scaffolding techniques from the previous lesson.

- Next, proactively create a positive emotional response to learning. Sousa claims that a learner's emotional investment in the content of what's being learned makes information easier to recall. This is because memories are not stored in one single part of the brain. An emotional aspect adds a dimension to the learning, making the memory of the lesson more easily accessible. So, when you're trying to connect with someone, work to create a joyous, supportive, fun, or funny environment.

- The last suggestion for creating a safe space is to create a community. Learning is a social endeavor. When people feel comfortable in a group or team environment, it's often in part because they feel a sense of community. And this is likely to foster more openness in communication among the members, leading to increased receptivity to learning.

> Some stress is essential to meeting challenges and can lead to better cognition and learning, but beyond a certain level, it has the opposite effect.

EXERCISE

Reflect back on a time you may not have created a safe space for communication, comprehension, or learning. Alternatively, reflect back to a time when you were not in a safe space yourself. Apply each strategy for creating a safe space to your own example and imagine how it might have gone differently.

Cognitive Entrenchment

- The anxious brain is one potential roadblock when connecting with others. The second roadblock is prior experience. Connecting to someone's prior experience is important to communicating effectively, but sometimes prior experience can actually create a roadblock.

- If you've ever tried to communicate with someone whose political or religious beliefs differ from yours, then you likely know how people can privilege their own experience and mistake it for objective fact. There's a fairly important distinction between facts and what is known as experiential knowledge. Experiential knowledge is something that we believe to be factual because we have experienced it. But making assumptions about the truth of these observations is problematic for many reasons.

- First, your observations aren't controlled or systematic, meaning they aren't scientifically rigorous. Second, you might see something and draw conclusions without finding out if your conclusions are actually correct. And third, human beings are notoriously poor observers due to differing perceptions, cognitive abilities, and biases. So what one person saw—and thus knows "for sure"—might look different for another person.

Suppose you have a pacifist friend who supports a politician who is a staunch opponent of gun control. That might be confusing to you, but research shows that your friend is likely attending to cognitive dissonance by downplaying or even altogether denying the new information.

- There's a fascinating concept in neuroscience called cognitive entrenchment, which is when our previous knowledge is deep-rooted and difficult to change. We tend to link our beliefs about the world to our personal and social identities. When those beliefs are challenged—even when that challenge comes in the form of concrete facts—it can feel like a personal attack.

- This is a pretty big roadblock. The worst thing you can do is debate and argue with the person. Instead, the single best way to get another person to open up to viewpoints opposite their own is to be open to genuinely learning more about them as a person. If you see each other as people rather than positional opponents, you may have more empathy for each other's viewpoints.

Incomplete Connection

- There's one more way in which prior experience can manifest as a roadblock. Have you ever had a situation where you were communicating something to someone and you could tell they were just not connecting with it? Perhaps they clearly had the wrong idea about what you were trying to explain, or perhaps they just looked confused.

- What's happening here is what James Zull calls an incomplete connection. It doesn't necessarily mean the listener is wrong—though it might—but it does mean they aren't making the connection we hoped they would.

- Most current evidence suggests that saying "no, that's wrong" to a learner does not remove that neuronal connection—in fact, it only makes it more complex. If you walk over a path many times, it gets more worn. If this person is making a problematic connection, engaging with that connection—even to say "no, that's wrong"—only deepens it. Instead, it's up to us to build a new neuronal network.

- The best way to do that is to build on the incomplete connection. It's typically possible to get this person where we want them to go; we just have to complete the connection. There's nothing you can do to remove the connection, so we can build on it and re-route it. Think of it like building a new exit ramp on an existing highway.

EXERCISE

Choose three examples—real or hypothetical—of communication scenarios where the listener has the wrong idea about something. Then, generate solutions to how you could re-route them toward your intended concept.

Reading

Cherry, "The Role of a Schema in Psychology."
Dane, "Reconsidering the Trade-off between Expertise and Flexibility."
Monner et al., "A Neural Network Model of the Effects of Entrenchment and Memory Development on Grammatical Gender Learning."
Siegelman et al., "Linguistic Entrenchment."
Sousa, *How the Brain Learns*.
Svoboda, "Why Is It So Hard to Change People's Minds?"

Questions

1 With regard to cementing knowledge, why is it important to create a positive environment for those you're communicating with?

2 True or false: There is no way to persuade someone who thinks differently than you to adopt your views, so don't even bother.

Bibliography

Bergen, Benjamin. *Louder Than Words: The New Science of How the Mind Makes Meaning*. New York: Basic Books, 2012.

This book is a fascinating—and humorous—take on how we make meaning through language. Bergen explores what we know about the brain to construct a new theory about meaning-making called embodied cognition. He uses humor and stories to illustrate the intersection of language use and understanding in and by our brains.

Boyd, Lara. "After Watching This, Your Brain Will Not Be the Same." TEDx Talk, 2015. https://www.youtube.com/watch?v=LNHBMFCzznE.

Dr. Boyd shares her research that demonstrates that the concept of neuroplasticity—the ability for the brain to continue to change when it learns—means that we can actually shape the brain we wish to have. She shares things we can do that prime the brain to learn.

BrainLine. "Interactive Brain." https://www.brainline.org/tbi-basics/interactive-brain?gclid=CjwKEAjw07nJBRDG_tvshefHhWQSJABRcE-ZamKJwCta_35HDpnc3ohg7evm4IxpsiHKgw5y0OsFVhoCpFvw_wcB.

BrainLine is a national multimedia project offering authoritative information and support to anyone whose life has been affected by brain injury or PTSD. This website offers an excellent overview of the areas of the brain, including explanations of what each area is responsible for and how injury to that area may affect the brain.

Budd, Ken. "Keep Your Mental Focus: Older Americans Have Superior Attention Spans." *AARP The Magazine*, November 27, 2017. https://www.aarp.org/health/brain-health/info-2017/mental-focus-smartphone-use.html.

This article examines the proliferation of smartphones in our lives, especially among younger individuals, and it examines the question of whether older adults are better at information processing due to the fact that they have not spent their lives media multitasking. The research suggests the answer to that question is yes. The article also offers tips for regaining focus in today's multimedia-saturated world.

Bullock, Olivia, Daniel Colón Amill, Hillary Shulman, and Graham Dixon. "Jargon as a Barrier to Effective Science Communication: Evidence from Metacognition." *Public Understanding of Science* 28, no. 7 (2019): 845–853.

The authors of this research study found that the use of jargon inhibits one's ability to process scientific information, and this in turn "leads to greater motivated resistance to persuasion, increased risk perceptions, and lower support for technology adoption." This suggests that anyone writing to inform or persuade an audience should avoid the use of jargon if they wish their message to have the desired effect.

Cabeza, Roberto, Steve Prince, Sander Daselaar, Daniel Greenberg, Matthew Budde, Florin Dolcos, Kevin LaBar, and David Rubin. "Brain Activity during Episodic Retrieval of Autobiographical and Laboratory Events: An fMRI Study Using a Novel Photo Paradigm." *Journal of Cognitive Neuroscience* 16, no. 9 (2004): 1583–1594.

This article reports on a research study conducted by Duke University researchers that found "clear evidence from humans that the brain's emotional center, called the amygdala, interacts with

memory-related brain regions during the formation of emotional memories, perhaps to give such memories their indelible emotional resonance." The study provides compelling new evidence about the important role emotions play in the formation and retrieval of memories.

Cepelewicz, Jordana. "To Pay Attention, the Brain Uses Filters, Not a Spotlight." *Quanta Magazine*, September 24, 2019. https://www.quantamagazine.org/to-pay-attention-the-brain-uses-filters-not-a-spotlight-20190924/.

This article examines how the brain engages in attentional processes and discusses a shift in how researchers study these processes. Historically, researchers have examined how the brain chooses to highlight certain information to attend to it, but more recently, focus is shifting to how the brain may actually suppress stimuli it does not want to attend to. The article also highlights new research that examines where in the brain these processes happen, suggesting that all attention processing does not occur solely in the cortex, as previously believed.

Cherry, Kendra. "The Role of a Schema in Psychology." Verywell Mind, September 23, 2019. https://www.verywellmind.com/what-is-a-schema-2795873.

This educational article explains what a cognitive schema is, including types and examples, and explores how schemas affect learning. It's a good introduction to this important cognitive concept.

Dane, Erik. "Reconsidering the Trade-off between Expertise and Flexibility: A Cognitive Entrenchment Perspective." *Academy of Management Review* 35, no. 4 (2010): 579–603.

In this article, the author shares research that suggests that the more expertise a person gains in a particular domain, the less flexible they become with regard to solving problems and generating creative ideas. He defines cognitive entrenchment as "a high level of stability in one's domain schemas" and suggests that two factors are likely to moderate one's level of entrenchment: the degree to which individuals engage in a dynamic environment within their expertise domain and the extent to which individuals focus their attention on tasks outside their expertise domain.

Gruber, Matthias. "This Is Your Brain on Curiosity." TEDx Talk, November 20, 2015. https://www.youtube.com/watch?v=SmaTPPB-T_s&list=PLMRXXLZiBk2k0OSEI3KHFHwW4rUJogWJs&index=8.

Matthias Gruber shares his research on the role of curiosity in learning and what happens in the brain when our curiosity is piqued. He likens piquing someone's curiosity to creating a curiosity vortex, whereby any learning that takes place will be more impactful and more readily recalled, regardless of what is being learned or how interesting or boring it is.

Horowitz, Seth. "The Science and Art of Listening." *The New York Times*, November 9, 2012. https://www.nytimes.com/2012/11/11/opinion/sunday/why-listening-is-so-much-more-than-hearing.html.

This article examines the distinction between hearing and listening from the perspective of attentional processes in the brain. The author offers a few easy tips for improving one's listening skills.

Kang, Sean. "Spaced Repetition Promotes Efficient and Effective Learning: Policy Implications for Instruction." *Policy Insights from the Behavioral and Brain Sciences* 3, no. 1 (2016): 12–19.

This article explores a body of literature on spacing out instruction to arrive at the conclusion that spaced review or practice "enhances diverse forms of learning, including memory, problem solving, and generalization to new situations." The research is focused on the teaching of children, not adults, but the implications are likely similar. The author discusses why, despite the plethora of research that indicates the positive impact of these practices, there are still roadblocks to its implementation in educational systems.

Lodge, Jason and William Harrison. "The Role of Attention in Learning in the Digital Age." *Yale Journal of Biology and Medicine* 92 (2019): 21–28.

This is an interesting article that examines the larger body of research regarding attention as it relates to learning and technology. The authors offer some conclusions about what the overall body of literature tells us about the intersection of these factors.

Maybin, Simon. "Busting the Attention Span Myth." BBC World Service, March 10, 2017. https://www.bbc.com/news/health-38896790.

This article pokes holes in the myth that our attention spans are growing shorter due to so much technology use. What the author reveals is that it's the premise itself that's flawed: It's not whether or not our attention spans are growing shorter but rather that the whole concept of an attention span is a misnomer. He reports on research from a psychologist who studies the brain that demonstrates that attention is contextual. Our attention span is impacted by how motivated we are to pay attention to something and how much attention the task itself demands.

Monner, Derek, Karen Vatz, Giovanna Morini, So-One Hwang, and Robert DeKeyser. "A Neural Network Model of the Effects of Entrenchment and Memory Development on Grammatical Gender Learning." *Bilingualism: Language and Cognition* 16, no. 2 (2013): 246–265.

The authors of this article explore why people who learn languages later in life tend to struggle more with language acquisition than those who do so earlier. Some research suggests this has to do with the impact of maturational processes. The authors suggest that entrenchment, which they define as "previous knowledge that is difficult to change and can perhaps only be altered slowly, thus interfering with the rapid acquisition of newly available information," is one of the factors at work in this phenomenon.

Nichols, Ralph and Leonard Stevens. "Listening to People." *Harvard Business Review*, September 1957. https://hbr.org/1957/09/listening-to-people.

This article represents a shift in perspective among successful business executives. Rather than focusing on how they talk, they are instead focusing on how they listen. The article posits that most people lack effective listening skills largely because we aren't taught these skills in school or in the professional world—yet we are expected to possess them anyway. It also offers some tips for improving one's listening skills.

Ophir Eyal, Clifford Nass, and Anthony D. Wagner. "Cognitive Control in Media Multitaskers." *Proceedings of the National Academy of Sciences of the United States of America* 106, no. 37 (2009):15583–15587.

This article discusses the results of a research study that examined whether there are significant differences in information processing styles among chronically heavy media-multitaskers versus light media-multitaskers. They found that heavy media-multitaskers

performed worse on a test of task-switching ability. The authors suggest that their results demonstrate that media multitasking definitely has an impact on how people process information.

Osth, Adam. "Here's Why Memories Come Flooding Back When You Visit Places from Your Past." The Conversation, October 24, 2019. https://theconversation.com/heres-why-memories-come-flooding-back-when-you-visit-places-from-your-past-124983.

This is an interesting article that explores how we associate things in our brains. It explains how and why our brains call up certain memories in certain contexts.

Siegelman, Noam, Louisa Bogaerts, Amit Elazar, Joanne Arciuli, and Ram Frost. "Linguistic Entrenchment: Prior Knowledge Impacts Statistical Learning Performance." *Cognition* 177 (2018): 198–213.

This article presents findings from a research study that shows that when the learning input is verbal in nature, participants experience higher levels of cognitive entrenchment, whereas when the learning input is visual, participants experience lower levels of cognitive entrenchment. The implications of this information for learning environments are also discussed.

Singh, Maanvi. "Curiosity: It Helps Us Learn, But Why?" NPR Ed, October 24, 2014. https://www.npr.org/sections/ed/2014/10/24/357811146/curiosity-it-may-have-killed-the-cat-but-it-helps-us-learn.

This article explores what happens in the brain when our curiosity is piqued as it relates to learning. Research has uncovered that the process of learning new things stimulates the same parts of the brain

that regulate pleasure and rewards. And research has also found that when our curiosity is piqued before learning, we are more likely to remember what we learned. This is true even when we are learning something boring.

Sousa, David A. *How the Brain Learns*. Thousand Oaks: Corwin Press, 2005.

In this book, the author uses current research on how the brain learns—for example, how memory works and the impact of technology use—to inform suggested tactics and strategies for teaching children in the classroom. Although it's focused on children, much of the science is still relevant for adults.

Svoboda, Elizabeth. "Why Is It So Hard to Change People's Minds?" *Greater Good Magazine*, June 27, 2017. https://greatergood.berkeley.edu/article/item/why_is_it_so_hard_to_change_peoples_minds.

This article explores why it can be so difficult to change people's minds, especially when addressing deeply entrenched beliefs. It explains what goes on cognitively and offers some practical suggestions for trying to move the needle.

Taylor, Kathleen and Catherine Marienau. *Facilitating Learning with the Adult Brain in Mind*. San Francisco: Jossey-Bass, 2016.

This book is a practical approach to the teaching and training of adults. It offers clear, easy-to-follow information about how the brain works, including some fascinating historical perspectives of how our knowledge about the brain has changed over time.

Ward, Adrian, Kristen Duke, Ayelet Gneezy, and Maarten. "Brain Drain: The Mere Presence of One's Own Smartphone Reduces Available Cognitive Capacity." *Journal of the Association for Consumer Research* 2, no. 2 (2017):140–54.

This article reports on the results of a research study that finds that "even when people are successful at maintaining sustained attention—as when avoiding the temptation to check their phones—the mere presence of these devices reduces available cognitive capacity." The authors examine the implications of this information for consumer welfare and decision-making.

Willis, Judy. "What You Should Know about Your Brain." *Educational Leadership* 67, no. 4 (2009). http://www.ascd.org/ASCD/pdf/journals/ed_lead/el200912_willis.pdf.

This is a brief handout meant to accompany a longer article. It's an excellent primer on how our brains process information and what we can do to maximize our brains' functioning.

Wilson, Clive. *No One Is Too Old to Learn*. Lincoln, NE: iUniverse, 2006.

This book is one of the first known sources to posit the theory of neuroandragogy—the science of how the adult brain learns. It offers a science-based look at how adults learn differently from children and discusses the role of brain plasticity in the learning process.

Wlodkowski, Raymond J. *Enhancing Adult Motivation to Learn: A Comprehensive Guide for Teaching All Adults*. San Francisco: Jossey-Bass, 2008.

This book is an excellent resource for anyone interested in learning more about strategies for teaching adults. It's chock-full of strategies for enhancing a person's motivation to learn by creating enthusiasm toward the topic, the instructor, and one's own self-efficacy as a learner.

Yuhas, Daisy. "Curiosity Prepares the Brain for Better Learning." *Scientific American*, October 2, 2014. https://www.scientificamerican.com/article/curiosity-prepares-the-brain-for-better-learning/.

This article reports on a fascinating study that found that asking an intriguing question to pique a person's curiosity immediately before they learn a piece of information makes it more likely that they learn that information and retain it in long-term memory. The article also explores the implications of this finding on educators, advertisers, and even those who work with Parkinson's patients.

Zull, James. *The Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning*. Sterling, VA: Stylus, 2002.

This book explores how to inform one's teaching practice by cultivating an in-depth understanding of what happens in the brain when we learn. It may be a bit in-depth in terms of neuroscience for the layperson, but it offers some fascinating insights into how learning impacts the brain and how teachers might rethink their teaching practices with this information in mind.

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